Explosives and Hazardous Devices Examinations

1 Scope

These procedures describe the process for explosives and hazardous devices examinations and apply to caseworking personnel who examine explosives and hazardous devices such as, but not limited to, main explosive charges, explosive devices, improvised explosive devices (IEDs), associated components, and their post-blast remains to determine identifying and functionality information.

2 Introduction

These procedures are designed to provide a general overview of the goals and approaches utilized by explosives and hazardous devices personnel in the forensic examination of evidence. The basic procedures described herein are geared towards the examination of IEDs, however, the principles are the same for the examination of other types of hazardous devices, such as, but not limited to, military explosive devices, military explosive device components, and hoax devices. Specifics related to the examination of individual items often found in bombing evidence are contained in separate Standard Operating Procedures (SOPs).

3 Equipment/Materials/Reagents

Refer to specific component examination SOPs for a list of items that can be used by personnel for the forensic examination of evidence. Explosives and Hazardous Devices personnel should choose the most appropriate items based on the nature of the evidence.

4 Standards and Controls

Not applicable.

5 Sampling or Sample Selection

Not applicable.

6 Procedures

The primary objective of explosives and hazardous devices personnel is to determine the physical construction and functioning characteristics of IEDs, or portions thereof, submitted as evidence, with the goal of ascertaining whether the device meets the technical elements of a

destructive device.[1] The methodology for the forensic examination of explosives and hazardous hazardous devices can be broken down into five (5) steps:

Step 1 - Segregation
Step 2 - Recognition
Step 3 - Identification
Step 4 - Function Determination
Step 5 - Comparison

It is important to note that the pressure (millions of psi) and temperatures (thousands of degrees Kelvin) generated in the explosive during the detonation process impose an inherent limitation to this examination process; some of the items can be so severely damaged that it may be impossible to complete every step of the process. These steps are listed only as an outline of the process used by personnel while examining evidence. The steps may be conducted in parallel or in any logical sequence depending on the nature of the evidence.

6.1 Segregation

Since IEDs can be constructed from various items, the first step in the examination process is the segregation of relevant items present in the evidence. Often items submitted as evidence were not part of the device, consisting instead of background debris from the scene of the explosion. Proper segregation of relevant evidence often requires communication with those who were on scene and is accomplished in part with the application of step two (2).

As part of the segregation process explosives and hazardous devices personnel will separate out items of forensic value for further examinations, and with the aid of personnel from other Laboratory units, select items to go to those units for examination. All items deemed forensically relevant will be photographed following the Evidence Photography SOP.

6.2 Recognition

All IEDs require an explosive and a mechanism that causes this material to explode. The explosive is referred to as the main charge and the mechanism causing the main charge to explode is referred to as the initiating, or fuzing, system. The purpose of a fuzing system is to supply energy to function the main charge. Fuzing systems are further categorized as being either non-electric or electric. For example, anything that can undergo combustion or create sufficient thermal output to induce chemical decomposition in a heat-sensitive, energetic material can potentially serve as a non-electric fuzing system. Electric fuzing systems tend to be more complex, usually requiring multiple electrical components such as, but not limited to, batteries, wire, and switches.

Based on these general principles, submitted items will be visually and/or microscopically examined to find those which could potentially function as components of an IED.

[1] 26 U.S.C. § 5845(f) and 18 U.S.C. § 921(a)(4), 2013

Based on the visual and/or microscopical examination, explosives and hazardous devices personnel will attempt to assign general attributes, or class characteristics, to items of evidence (e.g., determining that a particular item is a portion of a battery skin) that could potentially function as part of the IED. If possible, all items assigned general attributes will be taken to section 6.3.

6.3 Identification

The process of component identification requires the visual and/or microscopical analysis of a constellation of physical characteristics such as, but not limited to, material type, shape, and color. Other physical characteristics can be examined through measurements, including, but not limited to, distances, angles, and voltages. These measurements are not traceable, but are used to determine the dimensional value of technical parameters that may be relevant to affecting the identification of a particular component and determining its possible commercial manufacturing source. As the physical measurements outlined in device-related SOPs are not traceable, they are not subject to detailed error analysis to determine measurement uncertainties.

Each component determined to be part of the IED will be attributed to a potential source, as appropriate. Information such as the potential component manufacturer, brand, and type will be determined, as appropriate. If required, a *conclusive* determination as to the identification of an item will be made only if the source of the item is corroborated through direct communications with the distributor or manufacturer of the item. Specifics about a component, such as, but not limited to, availability and common uses, that might aid investigators should be sought out, as appropriate.

6.4 Function Determination

After the item identification process is completed, explosives and hazardous devices personnel will attempt to determine their role in the functioning of the IED. It is emphasized again in this step that the destruction created by the forces from the explosion of an IED may render a definitive determination of how it functioned impossible. Explosives and hazardous devices personnel must use their expertise to opine on the role of the components in the functioning of the IED, as well as how the overall IED might have been constructed and functioned. Caution must be taken not to overstep the bounds of what can be logically inferred from the examinations and facts of the case.

6.5 Comparison

There are two (2) general types of comparison examinations that occur in explosives and hazardous devices examinations: IED/known origin comparisons (between the components of an IED and items of known origin) and inter-device comparisons (comparison examinations between the components of multiple IEDs). In both examinations, visual and/or microscopical comparisons will be made between the physical characteristics of various items to determine if there are discernable differences with respect to those characteristics. These types of

examinations involve the comparison of observable characteristics, such as, but not limited to, component shapes, colors, and markings. The examinations may also involve comparison of measured, physical characteristics, such as, but not limited to, distances, angles, and voltages.

6.5.1 Inter-Device Comparison

Visual and/or microscopical and/or measurement comparisons are conducted between components (and their respective functioning) of multiple IEDs, such as, but not limited to, serial bombing investigations where the purpose is to determine if otherwise unrelated IEDs share common design and construction methods.

6.5.2 IED/Known Origin Comparison

Visual and/or microscopical and/or measurement comparisons are conducted between the components of an IED and items of known origin, such as, but not limited to, the recovered constituents of an exploded IED and components recovered from the search of a suspect's residence.

7 Calculations

Not applicable.

8 Measurement Uncertainty

Not applicable.

9 Limitations

The following are general limitations of the explosives and hazardous devices examination process described herein:

- Physical characteristics, such as, but not limited to, material type, shape, and color of evidentiary items are based on visual and/or microscopical observations, unless otherwise noted. Other parameters such as, but not limited to, distances, angles, and voltages associated with individual evidentiary items are based on physical measurements and are approximate, unless otherwise noted. Should a more complete characterization of these items be required, contributors can request additional examinations from the appropriate forensic discipline. Diagrams such as, but not limited to, drawings and schematics are not to scale, unless otherwise noted. Item source identifications that refer to a specific distributor or manufacturer have not been confirmed with that distributor or manufacturer unless otherwise noted.

- Examination(s) of explosives and hazardous device evidence can face extreme limitations which will vary on a case by case basis. The devastation to the physical surroundings imparted by energetic materials can make certain examinations impossible on items of evidence. For example, the explosion and/or fire resulting from the functioning of an IED can cause extensive damage, such as fragmentation, charring, or other severe alterations to items of evidence. Due to the destructive nature of these types of energetic events, conclusive determinations as to the recognition and identification of specific device components, as well as the exact design and functioning of the device, may not always be effected in every case.

Explosives and hazardous devices personnel must determine which examinations are appropriate based on what items have been deemed of forensic value. Further guidance is provided in the SOP titled Explosives and Hazardous Devices Report Writing Guidelines.

10 Safety

Safety protocols are contained within the FBI Laboratory Safety Manual as well as specific SOPs and will be observed at all times.

11 References

FBI Laboratory Division

FBI Laboratory Quality Assurance Manual, Federal Bureau of Investigation, Laboratory Division, latest revision.

FBI Laboratory Operations Manual, Federal Bureau of Investigation, Laboratory Division, latest revision.

FBI Laboratory Safety Manual, Federal Bureau of Investigation, Laboratory Division, latest revision.

Explosive Devices SOPs, Federal Bureau of Investigation, Laboratory Division, latest revisions.

Other

Beveridge, A., Forensic Investigation of Explosions, 2nd Edition, CRC Press, 2012

Kennedy, P.M., Explosion Investigation and Analysis – Kennedy on Explosions, Investigations Institute, 1985

Kennedy, J., Fires and Explosions – Determining Cause and Origin, Investigations Institute, 1990

Thurman, J.T., Practical Bomb Scene Investigation, 2nd Edition, CRC Press, 2011

Yallop, H.J., Explosion Investigation, The Forensic Science Society, 1980

18 U.S.C. § 921(a)(4) (2013)

26 U.S.C. § 5845(f) (2013)

Rev. #	Issue Date	History
0	07/07/2006	Original Issue to follow QATU formatting and ASCLD/LAB-*International* requirements.
1	10/02/2017	Administrative changes for grammar, clarity, and conformance to revised QAM and LOM. Removed references to the Explosives Unit to applicability to those conducting explosives and hazardous devices related examinations. Deleted Calibration section since it is no longer required. Rewrote the "Limitations" section to more accurately describe category of testing specific limitations. Removed references to "Q" and "K" items and replaced these references with "questioned" and "known". Updated references.
2	07/17/2018	Updated SOP title to reflect the full title of the forensic specialty. Administrative changes to Sections 1, 2, 6, 6.1 – 6.5, 6.51, 6.52 for grammar and clarity. Updated Section 6 to include the goal of the explosives and hazardous devices examiner in ascertaining whether the device being examined meets the technical elements of a destructive device. Updated Sections 6.2 – 6.3, 6.5, 6.5.1, 6.5.2 to clarify that items are visually and/or microscopically examined. Updated Section 9 for clarity and to further elucidate the general limitations associated with the explosives and hazardous devices examination process described herein.

Approval

Redacted - Signatures on File

Explosives and Hazardous Devices Technical Leader Date: 07/16/2018

Explosives Unit Chief: Date: 07/16/2018

QA Approval

Quality Manager: Date: 07/16/2018